

## Chapter 9: Sustainability

This chapter covers the following topics:

- Relationship of Sustainability to Planning Goals.
- Preservation of water quality.
- Preservation of local biodiversity, soils, and local agriculture.
- The use and disposal of material goods.
- Reduction of greenhouse gas emissions.
- Opportunities and Challenges posed by the Existing Conditions.

### Why the Acton 2020 Plan addresses Sustainability

Traditional comprehensive community plans are comprehensive in the sense that they address all important aspects of a town, from housing and economic development to transportation and public facilities. But it has become clear that the world is rapidly changing and that climate, energy and resource use are interrelated topics that have enormous implications for our children and grandchildren but have not traditionally been part of a comprehensive community plan. As discussed below, water quality is addressed in traditional plans, but because it has characteristics similar to climate and energy, it is also a subject of this element.

### Summary of Key Points

#### *Water Quality and Quantity*

- Preserving water quality and quantity includes measures to ensure that well-fields are protected from development that would lead to contamination or depletion; ensuring that on-site wastewater disposal (which is used by approximately 90 percent of properties in Acton) is properly managed and regulated; and managing storm water to maintain the quality supply of both surface water and groundwater. All of these functions are being performed by the Town and the Acton Water District.

#### *Agricultural Land*

- Farmland, which was once the predominant land use in Acton (including most areas that are now forested), has become scarce with the replacement of farms with houses and business areas.
- Local agriculture has importance to human ecology as well as serving as habitat. Active farms illustrate our connection to the land and recall Acton's history as a farming community.
- Local farming also serves the sustainability goal by connecting us to the source of our food, which in modern American society has become a matter of long-distance transport.
- Many communities have encouraged local farming through community-supported agriculture (CSA).
- Community gardens are another way of connecting people to the land, furnishing fresh produce to families, providing a healthy and creative use of leisure time that can involve people of all ages, and educating children regarding where our food

comes from. Acton has community gardens in North Acton and at Morrison Farm.

#### *Biodiversity*

- Acton contains major wildlife resources including five “hotspots” for biodiversity identified in the state’s BioMap 2 Project.
- Protection of biodiversity within Acton is primarily a matter of protecting land from development and ensuring that land which is developed is developed in ways that preserve natural habitat.

#### *Reducing Waste and the Accumulation of Toxins in our Environment*

- The number of households using the Transfer Station is approximately 4,000, (roughly half of all households). The other half of Acton’s households are served by private solid waste disposal firms
- In calendar year 2008, Acton reported a recycling rate of 22 percent of its solid waste. This is similar to Littleton but substantially less than the other adjoining towns, five of which exceed 40 percent.

#### *Conserving Energy and Reducing Carbon Emissions*

- Acton’s contribution of carbon dioxide from energy use is clearly a small part of the worldwide problem of global warming and climate change. However, mitigating the problem by reducing carbon emissions requires that all energy users be part of the solution.
- Acton is already engaged. The Town has taken the step of becoming a member of ICLEI – Local Governments for Sustainability<sup>1</sup>. In addition, Acton has been awarded Green Community status under the Massachusetts Green Communities Act. These sustainability commitments are the foundation of an ongoing program to carry out the Green Community commitments and the ICLEI milestones.
- As a result of its Green Community status, Acton was able to receive a \$150,000 grant for capital improvements and education programs to reduce municipal building energy use.
- Electricity use per square foot varies widely among Acton’s public buildings.
- Acton’s public buildings also vary considerably in natural gas use per square foot.
- Acton recently converted all of its street lights to energy conserving metal halide luminaires.
- Since 2006 residential electric use has declined by 10.6 percent, which may reflect consumer awareness of the need to conserve and particularly the replacement of incandescent lighting with compact fluorescent lamps.
- However, even with the recent reduction, households in Acton had an average electricity use of approximately 8300 kWh. According to NStar, the average residential customer uses 6,000 kWh per year, indicating that Acton households use substantially more than the average, possibly owing in part to the 10-11% of households that use electricity for home heating.

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<sup>1</sup> In 2003 the organization changed its name from International Council for Local Environmental Initiatives to “ICLEI – Local Governments for Sustainability.”

- Non-residential use of natural gas for heating (which includes public buildings as well as private business and industry) is of roughly the same magnitude as for all residential customers.
- Although the sources of data differ, the estimated average Acton household uses approximately 830 to 894 therms of natural gas each year. NStar's average residential gas heating customer uses 850 therms per year.
- Approximately 27 to 29 percent of Acton households use oil heat.
- The largest use of energy by residents of Acton is for transportation, accounting for an estimated 43 percent of the Town's carbon footprint and 59 percent of the residential portion of the carbon footprint. 80.8 percent of Acton residents commuted to work in 2000 by driving alone; another 7.4 percent used car pools, and 4.5 percent used public transportation; the remaining 7.7 percent walked, biked, or worked at home.
- Electricity and home heating fuel each account for approximately 20 percent of the residential portion of the carbon footprint.
- Acton households had the third lowest vehicle miles traveled among the nine adjoining towns, averaging 76.0 miles per day for all trip purposes. Nonetheless, driving is the single largest component of Acton's total carbon footprint.
- Trips for shopping, entertainment, socializing, medical appointments, and other purposes outweigh commuting trips by more than four to one. This is significant because even those residents who use modes other than driving alone to commute are likely to drive to most other destinations.
- Energy saving modes such as public transportation and shuttle bus, walking, and bicycling are highly dependent on favorable land use patterns that provide enough density to make public transportation feasible and destinations close enough together to make walking and bicycling reasonable alternatives.

## **Relationship to Planning Goals**

### *Goal: Ensure Environmental Sustainability*

The sustainability goal reads "As Acton residents, we recognize that our health and well-being depend on protecting the web of life of which we are a part. Therefore, it is vital that we live and work here in a manner that supports that web and the well-being of people everywhere, including future Actonians."

Although this goal has important implications – described below - for how the other goals are addressed in the Plan through public policies and actions, ensuring environmental sustainability also addresses the way we live and do business: by promoting public awareness and encouraging Actonians

- to do their part to preserve the groundwater resource in the way they use water and dispose of wastewater;
  - to reduce waste and the accumulation of toxins in the environment; and
  - to conserve energy in their homes and modes of transportation.
- It also includes public action to move toward patterns of land use and land protection that support biodiversity, soil preservation, and healthy local agriculture.

### *Goal: Preserve and Enhance Town Character*

Preserving local agriculture is both a way of maintaining ties to Acton's history and a tangible benefit for Actonians that use community gardens and locally produced food.

### *Goal: Provide Places for Gathering*

Energy efficient building practices can help make any indoor gathering places less expensive to operate. Local agriculture can provide an important place for community gathering and shared activities related to gardening and farming.

### *Goal: Improve Connections*

Transportation both within town and for commuting to places outside Acton has an important connection to energy use and the resulting emission of carbon dioxide to our atmosphere. Any transition from car use to bicycles or walking reduces fossil fuel use and reduces carbon emissions.

### *Goal: Maintain and Enhance Town Assets*

The groundwater under our feet is a public asset that provides most of Acton's drinking water and is a part of the water cycle that includes wastewater disposal. The use of energy in Acton's schools and other buildings results in emissions of carbon dioxide to our atmosphere. The town's facilities for recycling, and the use and disposal of material goods by the schools and town government have a direct connection to one of the sustainability objectives: To reduce waste. Acton's public open space has an important role in maintaining biodiversity within our borders.

### *Goal: Maintain and Improve the Financial Well-being of the Town*

Through action to conserve energy in public buildings, preserve water resources, and reduce the volume of solid waste that the Town must pay to have removed, there can be a substantial benefit to Acton's near term and long term budget.

## **Introduction**

Sustainability examines the relationship between the way we use resources today and their availability for future generations. The U.S. Environmental Protection Agency's (EPA) web page on sustainability states: "The traditional definition of sustainability calls for policies and strategies that meet society's present needs without compromising the ability of future generations to meet their own needs." A similar definition is provided in the book *Ecology of Commerce* by Paul Hawken: "Sustainability is an economic state where the demands placed upon the environment by people and commerce can be met without reducing the capacity of the environment to provide for future generations."

## **Preserving Water Quality**

Water quality is addressed in Chapter 3, Natural Resources, and Chapter 7, Facilities and Services. The focus of those chapters is on public policies to encourage and require water conservation and proper on-site disposal of wastewater, and the management of the public water and wastewater treatment systems and the stormwater management system.

Although Acton's water cycle is not a closed system, most of the water used in residences and businesses comes from the groundwater in the shallow aquifer underlying much of the town.

Preserving water quality and quantity includes measures to ensure that well-fields are protected from development that would lead to contamination or depletion; ensuring that on-site wastewater disposal (which is used by approximately 90 percent of properties in Acton) is properly managed and regulated; and managing storm water to maintain the quality supply of both surface water and groundwater. All of these functions are being performed by the Town and the Acton Water District. The discussion in Chapter 7 indicates that water, wastewater, and storm water are being well managed, but that there is a need for ongoing vigilance to protect water quality and supply.

One factor to note is that one of the more likely outcomes of climate change will be an intensification of storms in New England, with intense precipitation occurring more frequently than in the past. This means that design standards for stormwater structures will need to accommodate larger volumes. MADEP can be expected to adjust standards as necessary, but the Town may want to ensure that any new stormwater facilities are designed to accept runoff from more frequent and more intense storm events.

## **Preserving and Promoting Local Agriculture**

As noted in Chapter 3, Natural Resources, farmland, which was once the predominant land use in Acton (including most areas that are now forested), has become scarce with the replacement of farms with houses and business areas.

Acton Assessors classify 167 acres in agricultural use (97 acres in the Chapter 61 program and 70 acres of other farmland). Chapter 61 is a program that reduces the property taxes for land in agricultural use as an incentive to sustain farming and preserve agricultural soils. The program gives the Town a limited option to buy the land if it is removed from agricultural use and sold. In addition to the land assessed as agricultural, the state-owned agricultural land at the Route 2 gateway includes another 75 acres of agriculture, and other small agricultural fields total about 94 acres, for a total of 336 acres of agricultural land in the Town (2.6% of the total area). A list of horse farms in Acton is included in the appendix to Chapter 5, Open Space and Recreation.

Besides producing crops annually, this agricultural land is an important resource for a diversity of wildlife such as field-dwelling songbirds, hawks and owls; mammals such as deer, voles, rabbits, woodchucks, and coyotes; and snakes.

Local agriculture has importance to human ecology as well as serving as habitat. Active farms illustrate our connection to the land and recall Acton's history as a farming community. Thus, it has importance in maintaining the character of Town, which many people in Acton strongly identify with. Local farming also serves the sustainability goal by connecting us to the source of our food, which in modern American society has become a matter of long-distance transport from major agricultural areas across the continent and around the world. Having a local source of food conserves the energy and greenhouse gas emissions that otherwise would be used to transport it to Acton, and local agriculture is also symbolically important in maintaining the connection of our households to the land that provides at least some of our food. In the worst case of future climate change, crop failures in agricultural regions that export food to Massachusetts could make local sources of produce and other foods more important to Acton.

Table 9.1: Active Farms in Acton

Name	Address	Type	Website
Idylwilde Farm Inc	366 Central St, Acton	store/ fresh produce	www.idylwildefarm.com
Stonefield Farm	91 Martin St, Acton	flowers/produce	www.stonefieldfarm.net
Butterbrook Farm	982 Main St, Acton	organic produce	www.butterbrookfarm.com
Cucurbit Farm	32 Parker St, Acton	produce, corn	www.cucurbitfarm.com
MCI Northeastern Correctional Facility farm fields	Route 2 gateway area	produce, corn	N/A

### Community-Supported Agriculture

Many communities have encouraged local farming through community-supported agriculture (CSA). These farms are operated by subscription of members who pay in advance of the growing season for weekly pickups or shares of produce (and sometimes meat, cheese, or eggs). Some of these farms also sell produce at roadside stands. CSAs have skilled manager-farmers as well as volunteer work by members. Examples near Acton are First Root Farm and Kenney Farm in Concord and Springdell Farm in Littleton. The benefits of CSAs include the preserving of agricultural land in active farming, providing a real and symbolic local connection to the land, a source of farm-fresh produce for family diets, and an educational opportunity for children. All of these benefits support the sustainability goal, and CSAs often become gathering places for members and other residents.

### Community Gardening

Community gardens are another way of connecting people to the land, furnishing fresh produce to families, providing a healthy and creative use of leisure time that can involve people of all ages, and educating children regarding where our food comes from. The North Acton Community Gardens serve approximately 24 families who have garden plots on a portion of the 5.1 acres of land. The community gardens on the recently acquired 35 acre Morrison Farm consist of 36 active garden plots on about 2 acres. There is demand for more plots.

The new Acton-Boxborough Farmers Market provides Acton residents with fresh produce (and specialty goods like handmade soap) from local farms, and it is also a place for community gathering. It is held on Sundays from July through October on Pearl Street in West Acton Village.

### Preserving Biodiversity

As described in Chapter 3, Natural Resources, Acton contains major wildlife resources including five “hotspots” for biodiversity identified in the state’s BioMap 2 Project:

- NARA/Wills Hole/Kennedy/Marshall Land/Nashoba Sportsman Club (partially town-owned and Zone II Wellhead Protection Area),
- Grassy Pond (partially town-owned),
- Assabet River in southeastern corner of town, including portion of Zone II Wellhead Protection Area,

- Heath Hen Meadow, a wetland area and wetlands along the town boundary with Stow and Maynard, including a portion of a Zone II Wellhead Protection Area for public wells in Maynard (which Acton has not chosen to regulate based on current data), and
- Reformatory Fields/Wetherbee Conservation Land, including portion of a Zone II Wellhead Protection Area.

In addition, Acton has approximately 7,000 acres of forest land (more than 50% of its total area), much of which is on residential lots and unprotected land, as well as the forested land in Acton's protected conservation areas. The habitat resources include 23 certified vernal pools and 142 potential vernal pools – important habitat for wood frogs, salamanders, etc. Many of these are located on unprotected land. Finally, Acton includes habitats for 9 state-listed rare plant or animal species. These habitats are concentrated along the major brooks.

Protection of biodiversity within Acton is primarily a matter of protecting land from development and ensuring that land which is developed is developed in ways that preserve natural habitat, e.g., through use of the zoning bylaw's Open Space Development or Planned Conservation Residential Community (PCRC) provisions. Some plant and animal biodiversity in Acton is threatened by the growth of large monocultural stands of invasive plants, such as Phragmites, Garlic Mustard, purple loosestrife, and many others. Volunteers working with the town's natural resources department have started executing a long-range plan to reduce the impact of some of these species. As discussed in Chapter 5, Open Space and Recreation, Acton has a relatively large share of its land in public open space, two-thirds of which is permanently protected. The Town's major conservation areas are well managed and serve the purpose of preserving biodiversity.

## **Reducing Waste and the Accumulation of Toxins in Our Environment**

Acton, like most American communities with relatively affluent populations, enjoys a high material standard of living. This translates into a high level of material goods ranging from automobiles to iPods. The material economy depends on the accumulation and replacement of material goods, which embody the raw materials and energy that went into their manufacturing. These goods eventually wear out or become obsolete as technology advances and consumer preferences change. Most of these goods, and the packaging they came in, end up in the solid waste stream.

The Town of Acton does not provide curbside trash pickup, but a substantial proportion of households pay for private pickup of their solid waste. The rest bring their solid waste to the Town Transfer Station and Recycling Center (TSRC) on Forest Road, off westbound Route 2<sup>2</sup>; it is pooled there and trucked away to the NESWC incinerator in North Andover, where it is burned. The burning creates energy along with air pollutants. The remaining toxic ash, which is 30% of the waste, is trucked to various regional landfill disposal sites.

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<sup>2</sup> This has positive and negative aspects: individual automobile trips to the TSRC add to Acton's carbon footprint; at the same time, the TSRC also serves as an important gathering place for Actonians.

There were approximately 4,200 stickers sold for use of the Transfer Station in 2010; Town staff estimates that 200 of these are extra stickers for households that use more than one vehicle to bring their trash to the Transfer Station, so the number of households using the Transfer Station is approximately 4,000, (roughly half of all households). The other half of Acton's households are served by private solid waste disposal firms; many of these households are in condominiums or rental units where the association or management arranges for pickup of all solid waste.

## **Recycling**

Depending on individual initiative, a portion of each household's solid waste is recycled.

Some, but not all, of the private solid waste disposal companies provide recycling, in some instances at no additional cost. At least one company serving Acton (Waste Management, Inc.) offers single-stream recycling without additional charge. This means that paper, cardboard, plastics, glass and metal containers can be mixed in a single bin for pickup. Single stream recycling is easier for consumers than separating various types of recyclables, and it thus promotes recycling.

Materials for recycling at the Transfer Station must be divided by type and deposited in bins at the Recycling Center:

- paper/cardboard (all paper and boxes, no plastic);
- glass bottle, can and plastic container bin (clear, green and brown glass, deposit and non-deposit cans, foil and plastic containers with recycling labels 1 to 7);
- yard waste disposal bin (grass, leaves, plants, woodchips, twigs and Christmas trees);
- ash disposal area;
- waste oil area;
- scrap metal pile and white goods area (which requires a verification with the attendant and possible fees for metal appliances).

There is also a donation area where bottles and cans with deposits can be left as a donation to the Acton Community Supper and where clothing can be donated to the Salvation Army.

Certain items are accepted at the TSRC only with a coupon. These are generally appliances, furniture and other household fixtures that would normally not be recyclable or accepted as household waste. The website for the TSRC gives examples including tires, bed frames, doors, stoves, sinks, dishwashers, refrigerators, air conditioners, etc.

There are other materials that are considered unacceptable except on specified Hazardous Waste Days (held twice a year). These materials include solvents, asbestos, batteries, cement/concrete, computer monitors, fluorescent bulbs/fixtures, gasoline, medical waste, oil paints, chemicals, propane tanks, pesticides, lumber, stones, computer monitors, and televisions.

Recycling has been an environmental success story in the United States, with most households recycling at least some of their solid waste. Many people consider recycling an affirmation of their commitment to the environment and a lower impact life style. Children tend to be particularly enthusiastic about recycling.

Massachusetts Department of Environmental Protection (MADEP) compiles reported recycling rates from all Massachusetts communities. Table 9.2 shows reported recycling rates for calendar year 2008 for Acton and its adjoining communities.

Table 9.2 Reported Recycling Rates in Calendar Year 2008

Community	Percent
Acton	22%
Boxborough	43%
Carlisle	41%
Concord	47%
Littleton	23%
Maynard	48%
Stow	n/a%
Sudbury	45%
Westford	34%

Source: MADEP

In calendar year 2008, the last for which there is published MADEP data, Acton reported a recycling rate of 22 percent of its solid waste. This is similar to Littleton but substantially less than the other adjoining towns.

Education and public information can increase participation in recycling, but the best results are obtained where there is an incentive for recycling and/or a disincentive for not recycling. Mixed, single stream recycling at the TSRC is a possibility that could be explored.

Acton collects a user fee from each household by selling annual stickers that cost \$185 for the first sticker and allow use of the TSRC without further charge; without the sticker, the charge is \$30 per trip to the center.

Some communities have increased recycling by requiring the use of official trash bags (or a sticker for each bag) for non-recyclables but making recyclables free, thus providing a disincentive for mixing recyclables and non-recyclable solid waste. This option (formerly known as “Pay As You Throw”) was rejected by Acton voters at a 2008 Special Town Meeting, but a revised version of a system of this sort may have an important role in Acton's future, as disposal costs rise.

From the Town's point of view, there is a substantial cost in having the solid waste trucked away. Recyclables have market value that can reduce cost and in some circumstances actually provide a net positive return that reduces overall costs. However, the market for recyclables is relatively volatile, and separation of materials such as aluminum and steel cans, paper, and plastics, has the potential to improve the overall return. Mixing recyclables of several types typically increases recycling but generally also increases the cost (or reduces the return) for recycling. Nonetheless, it may be worthwhile to consider a solid waste contractor with single stream recycling; in such a system Acton households would receive recycling bins that can be used for a mixture of paper, cardboard, cans, glass bottles, and plastic, and these items could be deposited in a single receptacle at the TSRC.

From the point of view of reducing toxins in the environment, it is important to provide a means for accepting hazardous wastes, including expired prescription medication, as described above, and to encourage households to keep these materials out of the general waste stream.

Finally, many people who are committed to environmental sustainability attempt to go beyond the manner in which their solid waste is disposed to actually reducing the amount of material that they utilize. Methods for doing this include repairing or swapping goods to keep them out of the waste stream, and reducing the amount of material goods they purchase in the first place. This extends beyond what is usually addressed in a comprehensive plan, but there are some ways that this aspect of sustainability can be addressed by the town.

Beginning in 2010 Acton held a Drop/Swap Day on which households can leave usable goods at the Conant School or find used goods that they need. This was organized by Green Acton [www.greenacton.org](http://www.greenacton.org) and is planned to be repeated annually. There is also an Acton Freecycle group that participates in the national Freecycle Network <http://www.freecycle.org>. Freecycle members can post and claim unwanted articles free through the Acton Freecycle group at Yahoo.com. The Acton Freecycle list is very active and Green Acton estimates that hundreds of items are saved from disposal each month.

Finally, there are programs such as Green Living teams in which small groups of people get together to discuss all aspects of sustainable living, including the way they use and dispose of material goods, and encourage each other to live more sustainably.

## Use of Energy and Carbon Footprint

An increasingly urgent aspect of environmental sustainability today on a worldwide scale is the contribution of human activities to the global warming that causes climate change. Global warming is a direct physical result of increasing concentrations of carbon dioxide, methane, and other greenhouse gases (GHG) to the atmosphere; climate change is the result of warmer atmospheric and ocean temperatures. The primary cause of global warming and climate change is the use of energy from fossil fuels (petroleum, coal, and natural gas) as well as agricultural practices and deforestation that occurs on a large scale throughout the world<sup>3</sup>. The carbon intensity of fossil fuels varies with the type of fuel that is used: coal has the highest carbon dioxide emissions per unit of energy (generally expressed in “British Thermal Units” (BTU)); petroleum has lower emissions, and natural gas is the “cleanest” fossil fuel but still contributes major amounts of carbon dioxide when it is burned. (In addition, the extraction and mining practices of fossil fuels are themselves environmentally damaging, with impacts ranging from the devastation of mining sites, oil spills during offshore drilling, to the injection of toxic chemicals during natural gas extraction from shale deposits.) Electricity is produced by a variety of means, so the New England power grid uses a mixture of sources with all of these fuels represented, as well as nuclear, hydro, and some wind-generated energy.

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<sup>3</sup> The scientific evidence for global warming caused by human activity is unequivocal: while some individual scientists may differ, every synthesis of the published scientific research has strongly supported this conclusion. Nonetheless, many individuals in the United States dispute this conclusion, and their viewpoint must be acknowledged as part of the political dialog.

Since this is a worldwide problem, Acton's contribution of carbon dioxide from energy use is clearly a small part of the total. However, mitigating the problem by reducing carbon emissions requires that all energy users be part of the solution. The bottom line is that reducing our carbon footprint is the right thing to do. Part of the solution to this global problem is a change in how we use energy at the local community level. Civic action to help mitigate the problem in a coordinated way can be more effective and inspiring than individual initiative.

### **Acton's Commitment's to Sustainability**

Acton is already engaged. The Town has taken the step of becoming a member of ICLEI – Local Governments for Sustainability, an association of over 1200 local government members who are committed to sustainable development. The Board of Selectmen adopted the ICLEI Declaration of Sustainability in December 2009. This entails a pledge "to reduce both greenhouse gas and air pollution emissions throughout the community."

Specifically, the ICLEI pledge commits Acton to:

- conduct a greenhouse gas emissions inventory and forecast to determine the source and quantity of greenhouse gas emissions in the jurisdiction;
- establish a greenhouse gas emissions reduction target;
- develop an action plan with both existing and future actions which when implemented will meet the local greenhouse gas reduction target;
- implement the action plan; and
- monitor to review progress.

In addition, Acton has been awarded Green Community status under the Massachusetts Green Communities Act. This designation required the following commitments to be made:

1. As-of-right siting for renewable or alternative energy generating, manufacturing or R&D facilities in designated locations;
2. Expedited permitting process for approving such facilities within one year of the filing of an application;
3. Preparation of an energy use baseline and a program to reduce energy use by 20% within 5 years (This applies just to municipal and school operations, while the ICLEI pledge applies to the town as a whole. The Town is using the Massachusetts Energy Insight software to track energy use in public buildings);
4. A policy to purchase fuel-efficient vehicles; and
5. A policy to minimize lifecycle energy and water costs for all new commercial, industrial and large-residential construction (the 'Stretch Energy Code').

These sustainability commitments are the foundation of an ongoing program to carry out the Green Community commitments and the ICLEI milestones.

In addition, Green Acton [www.greenacton.org](http://www.greenacton.org) is a non-government volunteer organization that provides civic education, advocacy, and a broad range of initiatives that promote sustainability.

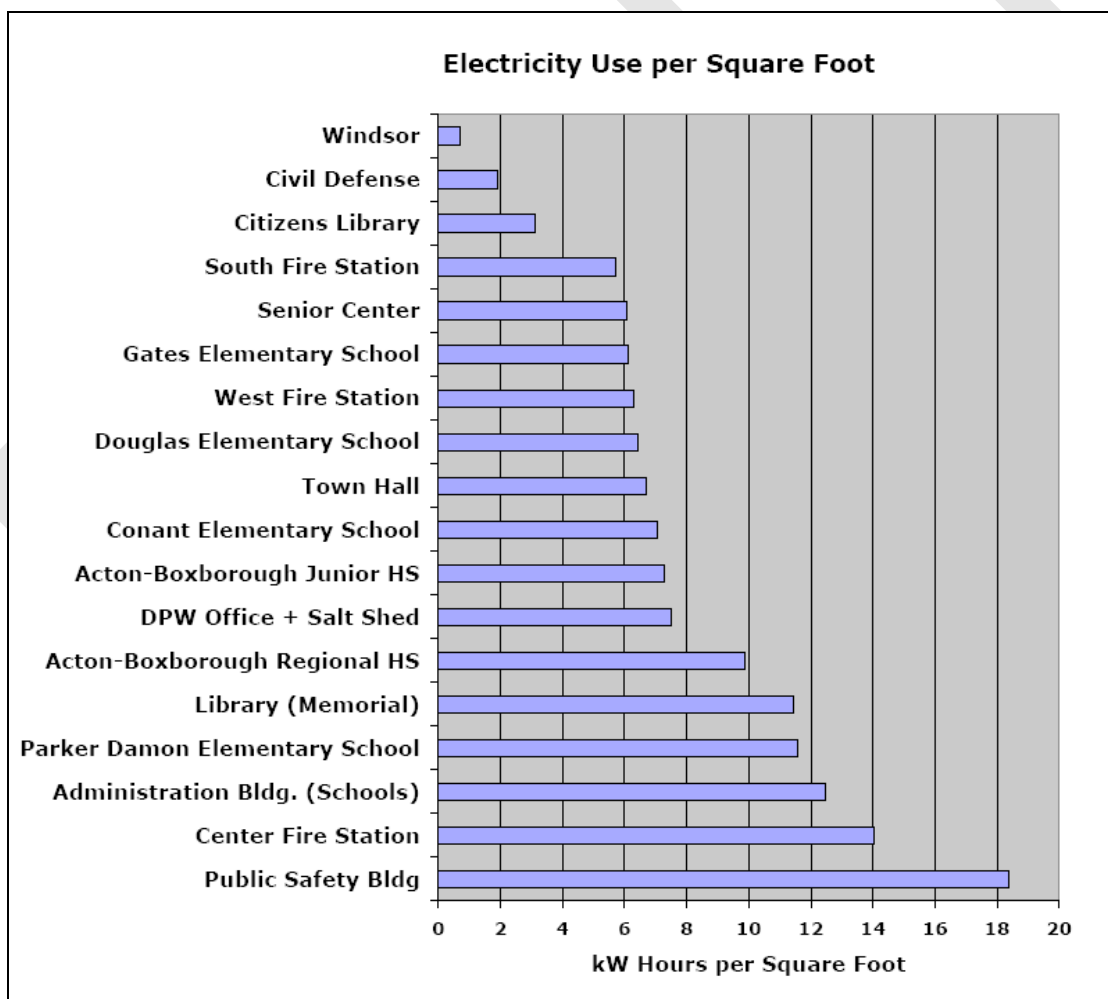
## Energy Use in Public Facilities

As a result of its Green Community status, Acton was able to receive a \$150,000 grant for capital improvements and education programs to reduce municipal building energy use. As noted in Chapter 7, Facilities and Services, the Municipal Properties Department and the School Department have accomplished a number of projects to make heating/ventilation/air conditioning systems more energy efficient and to reduce energy loss in public buildings by making them more weather tight. Further projects of this type are planned, some of them using the Green Communities grant money; an example is replacement of water heaters with efficient tankless models.

The Acton Green Advisory Board collected data on the use of electricity and natural gas in all of Acton's public buildings for FY2009.

*Figures 9.1 and 9.2 show the electricity use from that baseline per square foot floor area of each building, giving a picture of energy intensity.*

Figure 9.1 Acton Public Building Annual Electricity Use per Square Foot

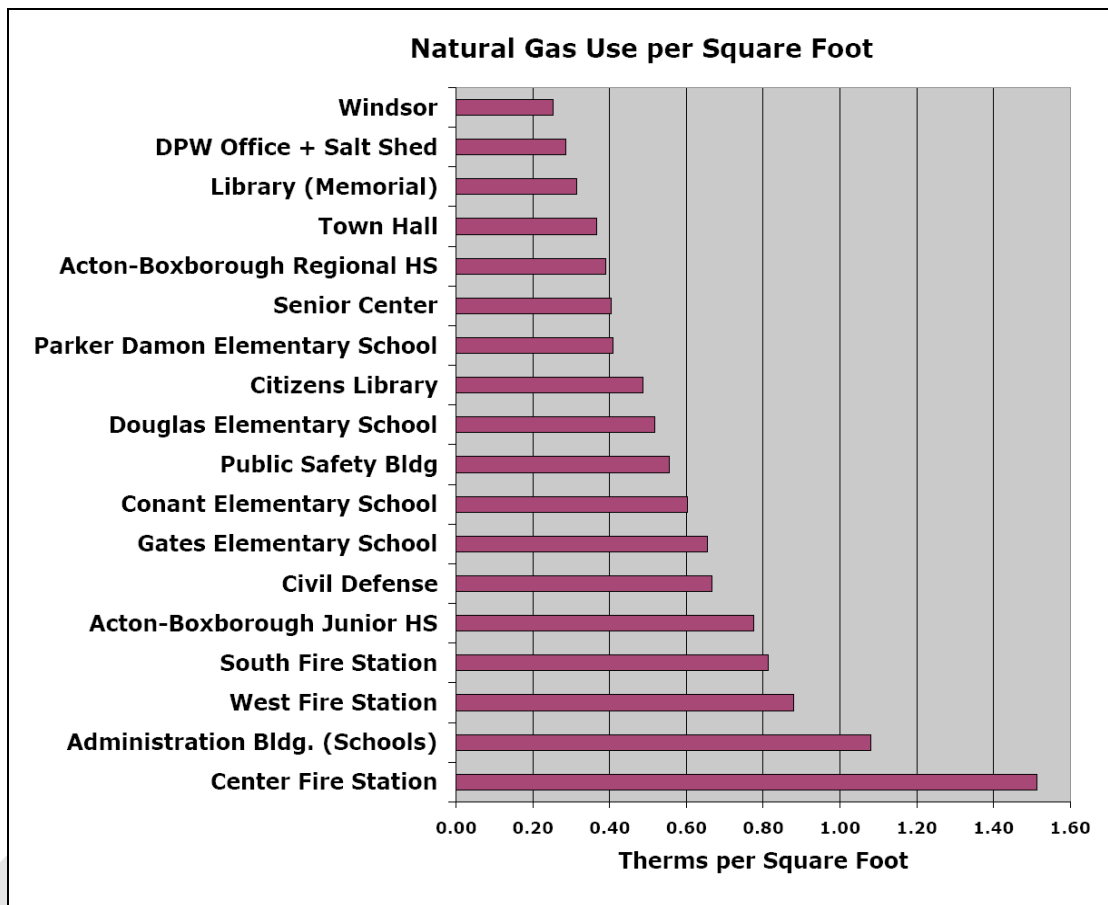


Source: Green Communities benchmark data for FY2009 and Town facilities floor areas

The electricity used per square foot varies widely among Acton's public buildings. Electricity use is clearly higher in buildings that are used around the clock (fire stations

and public safety building), and those with extended hours of operation like Memorial Library. However, the usage at some of the schools may indicate that lights are left on in classrooms after the end of the school day.

Figure 9.2 Acton Public Building Annual Natural Gas Use per Square Foot,



Source: Green Communities benchmark data for FY2009 and Town facilities floor areas

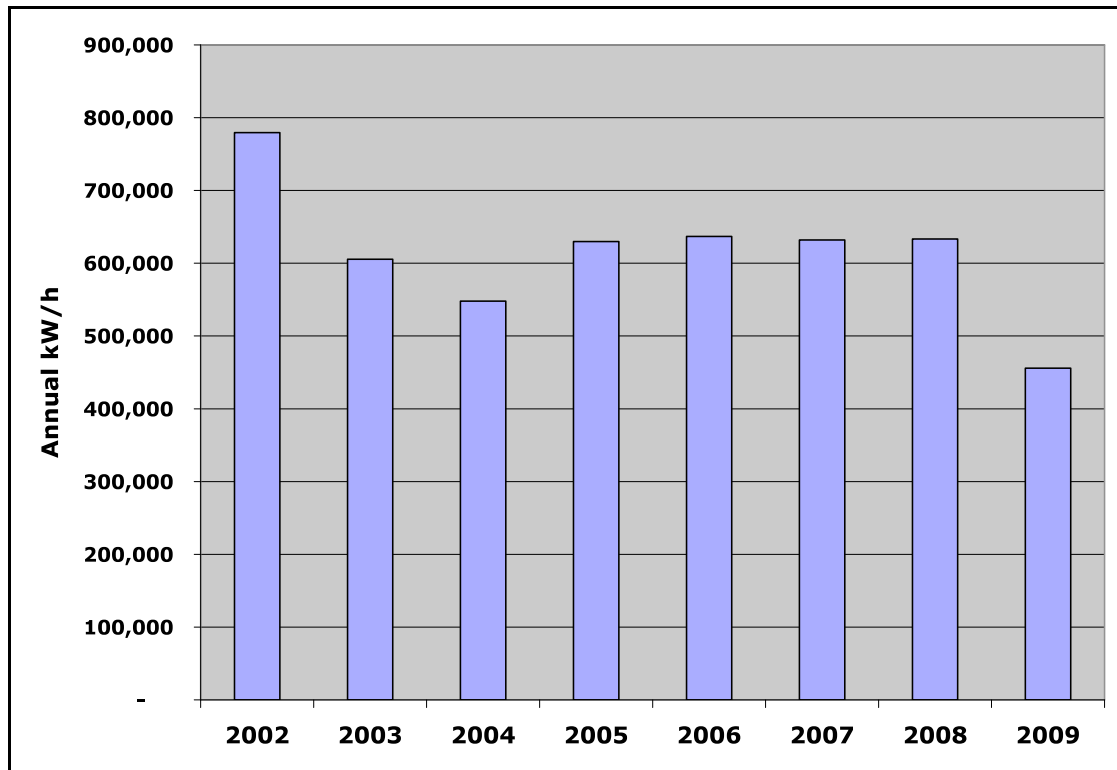
Acton's public buildings also vary considerably in natural gas use per square foot. Natural gas use per square foot is an indicator of building energy efficiency. In general, buildings that are newer or that have recently been improved to conserve energy have much lower heating and cooling energy use per square foot than older buildings, particularly fire stations which may lose heat through their large overhead doors.

A staff coordinator was hired to assist the schools in encouraging energy saving practices by faculty and staff. These practices are often as simple as turning off lights at the end of the day, which has been proven in other school systems to substantially reduce electricity use.

Street lighting is also a significant use of electricity. Acton recently converted all of its street lights to energy conserving metal halide luminaires. These are more energy efficient than the mercury vapor lights they replaced; the new lights are also designed to shield houses and other adjacent properties from glare and to reduce light pollution of the night sky by directing the light down to the ground where it is needed.

Figure 9.3 shows the electricity used in Acton's street lights. The drop in 2009 electricity use is due to the replacement of the old lights.

Figure 9.3: Electricity Use for Acton Street Lighting by Calendar Year



Source: NStar

Total annual energy use in public buildings is approximately 10.375 million kilowatt hours (kWh) and 522,000 therms of natural gas. Converting these units to millions of BTU<sup>4</sup>s (mmBTU) gives a total use in public buildings of 87,590 mmBTU. This number is significant primarily as a benchmark for comparison with future energy use.

### Community-wide Carbon Footprint

Acton's total "carbon footprint," i.e., its total energy use, converted to annual tons of carbon dioxide, is composed of six major parts:

- Home, business, and public electricity use for lighting, cooking, water heating and some space heating;
- Home, business, and public natural gas use for space and water heating and cooking;
- Home, business, and public heating oil use for space heating;
- Fuel use for private and public transportation;
- Energy embodied in the production, use and disposal of objects;
- Energy associated with solid waste.

<sup>4</sup> 1 mmBTU = 10 therms; 1 mmBTU = 293.1 kW hours.

The first four items in this list comprise the “primary” footprint, i.e., energy directly used by households, businesses, and town government; the last two items are the “secondary” footprint, which comprises energy used to produce the material goods used in Acton. The energy use in the secondary footprint may occur anywhere in the world, including overseas where many consumer goods are produced; it is as relevant to climate change as the energy actually used within the Town.

The available data on residential energy use are not entirely consistent, so the estimates that go into the overall carbon footprint will remain somewhat uncertain, at least until the detailed information from the 2010 U.S. Census becomes available in 2012. Data on the fuel used for home heating comes from the 2000 Census and the 2009 Census Bureau American Community Survey, as well as data provided by National Grid for natural gas.

Table 9.3: U.S. Census Data on Heating Fuel Used in Acton Housing Units, 2000

Type of Heating Fuel	2000		2009	
	Number of Households	Pct of Total	Number of Households	Pct of Total
Natural Gas from Utility	3,109	41.5%	3,266	44.2%
Fuel oil, kerosene, etc.	2,994	39.9%	2,657	36.0%
Electricity	1,176	15.7%	1,058	14.3%
Bottled, tank, or LP gas	163	2.2%	335	4.5%
Wood	35	0.5%	49	0.7%
Solar energy	6	0.1%	0	0.0%
Coal or coke	0	0.0%	0	0.0%
Other Fuel			23	0.3%
Total Housing Units	7,495	100%	7,388	100%

Source U.S. Census 2000, U.S. Census Bureau American Community Survey, 2009

Note: The 2009 figures are an estimate based on a small sample of Acton households; it underestimates the number of households (8,415), but the percentage breakdown is probably representative of all households.

It is noteworthy that while approximately 81 percent of households used natural gas or heating oil in 2000, nearly 16 percent used electric heating, which is substantially more costly. The American Community Survey estimates for 2009 are based on a small sample which is probably not sufficient for comparison for the small numbers such as bottled gas, solar, or wood; but the estimates seem to indicate some shift away from heating oil and electric heat and toward natural gas from National Grid, the utility that provides gas to Acton residences. (However, National Grid data indicates a greater shift than estimated by the Census Bureau for 2009.)

The use of electric heating by roughly one-sixth of the households in Acton increases average use of electricity, as discussed below, compared to the majority of households that use natural gas, oil, or other sources of heat.

## Natural Gas

National Grid provided information on the amount of natural gas they supplied in 2009 and 2010. This data is shown in Table 9.4.

Table 9.4 Natural Gas Use by Residential and Non-Residential Customers, 2009-2010

Rate Group	2009		2010		Consumption per Account		
	Number of Accounts	Total Gas Consumption (therms)	Number of Accounts	Total Gas Consumption (therms)	2009	2010	Percent Change
Residential Heat	3,963	4,315,667	4,192	4,114,452	1,089	982	-4.7%
Residential. Non-Heat	105	24,016	104	20,481	229	197	-14.7%
Commercial/ Industrial/ Public	646	4,455,738	660	4,101,121	6,897	6,214	-8.0%
Total		8,795,421		8,236,054			-6.4%
Heating Degree Days					10,224	9,402	-8.0%

Sources: National Grid; degree days from [www.degreedays.net](http://www.degreedays.net) at Acton Great Hill weather station.

The table shows that non-residential use of natural gas for heating (which includes public buildings as well as private business and industry) is roughly the same magnitude as all residential customers. Residential use of natural gas per account decreased from 2009 to 2010; however, the number of heating degree-days was smaller in 2010 by a larger margin, indicating that the use of energy for heating would have increased slightly if the weather had been the same in both years.

Using the data from Table 9.3, approximately 44 percent of Acton households used natural gas for heating in 2009; applying this percentage to the estimated 8,415 households yields 3,720 households heating with gas. However, the data from National Grid is probably more reliable than the American Community Survey estimate; 4,192 household accounts is equivalent to 49.8 percent of Acton's 8,415 households. It is likely that there are some National Grid accounts for large multifamily buildings in which there is not a separate gas meter for each unit, and this would further increase the estimated number of households using natural gas heat.

There are 410 households in Acton living in buildings with 50 or more units and 708 living in buildings with 20 to 49 units. If only the largest buildings (50 or more units per building) had a single gas meter, there would be an additional 409 households with gas heating, raising the total to 4,601 households (55% of all Acton households) using natural gas for heating. If half of the buildings with 25 to 49 units also have a common gas meter for all units, this would raise the total to 4,954 households with gas heat (59% of Acton households). These estimates are substantially higher than the 44% from the 2009

American Community Survey, indicating smaller percentages of homes that use heating oil or electricity for heat.

Dividing total residential gas consumption in 2010 by 4,601 gives a per-unit average of 894 therms per household. This is higher than the statewide average of 850 therms reported by NStar, the other major natural gas utility. Dividing by the higher estimate of 4,954 households gives a per-unit estimate of 830 therms per household.

More data is needed to observe any trends in energy use that result from efforts to encourage conservation by residents and businesses. However, the above data provides a rough estimate that can be refined when 2010 Census data becomes available and a baseline against which future energy consumption can be evaluated.

Therms are converted to pounds of CO<sub>2</sub> at the rate of 11 pounds per therm in the footprint summary Table 9.7 below.

### Heating Oil and Electric Heat

As noted above in the calculation of natural gas use, 55% to 59% of Acton households use gas for heating, leaving 41% to 45% that use heating oil, electricity, or other fuels such as wood or bottled gas. Based on the calculation and Census data and estimate in Table 9.3, it is likely that heating oil customers account for approximately 65% of the non-gas households (27-29% of all households), and users of electric heat account for approximately 30% of non-gas households (10-11% of all households).

Table 9.5 provides a rough proportion of heating fuel shares, based on the National Grid data and Census estimates.

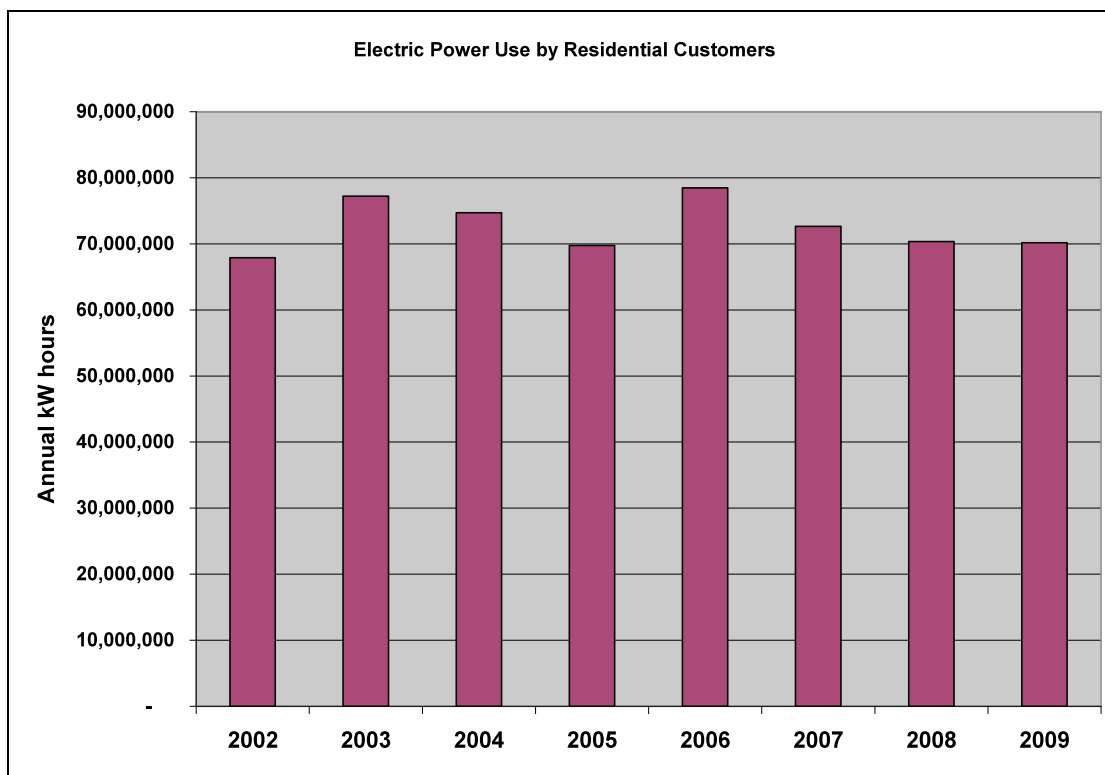
Table 9.5 Assumed Shares of Residential Heating Fuels

Number of Households	Number of Households	Percent of Households
Natural Gas from National Grid	4,600 – 4,950	55% - 59%
Heating Oil	2,250 – 2,475	27% - 29%
Electricity	870 – 960	10% - 11%
Other Fuels	300 – 380	4% - 5%
All Households	8,415	100%

The electricity used for home heating is already included in the total residential electricity use. The amount of heating oil used by Acton households can be roughly estimated by using a typical figure of 800 gallons of heating oil per year; this translates into approximately 41,000,000 gallons per year for all households using heating oil. This figure is converted to pounds of CO<sub>2</sub> in the footprint summary Table 9.7 below, using a conversion value of 22 lbs CO<sub>2</sub> per gallon of heating oil.

## Electricity

Figure 9.4 shows residential electricity use, based on data provided by NStar



Source: NStar

The data does not show a significant trend until 2006; since then residential electric use has declined by 10.6 percent, which may reflect consumer awareness of the need to conserve and particularly the replacement of incandescent lighting with compact fluorescent lamps. Stated another way, the residential electricity use in 2008 and 2009 was approximately 3.2% to 3.4% less than the average for 2002 through 2009.

For non-residential customers (including public buildings), the electricity use in 2009 was approximately 5.7% less than the average of 102 million kWh for 2002 through 2009.

Based on the 2009 total of approximately 70,000,000 kWh, the 8415 households in Acton had an average electricity use of approximately 8,300 kWh. According to NStar's carbon calculator website, the average residential customer uses 6,000 kWh per year, indicating that Acton households use substantially more than the average. This may be due in part to the proportion of households that have electric heat.

The CO<sub>2</sub> emissions per kilowatt hour of electricity depend on the efficiency of each electricity generation plant that contributes to the electrical grid and the type of fuel used by each generator. This can vary widely from place to place and over time from over 2 lbs CO<sub>2</sub> per kWh where coal is the energy source to zero for hydro and nuclear. The conversion factor used in this inventory report is 1.4 lbs per kWh, which is the value currently used by NStar in their on-line carbon calculator.

## Transportation

The third major use of energy by residents of Acton is for transportation. Nationally, 28 percent of energy<sup>5</sup> is used in transportation of all kinds, and the predominant mode is automobile transportation. A major part of the sustainability problem is that, while automobiles can achieve higher fuel economy through engineering and use of technologies like hybrid power trains, these gains are wiped out by rising trends in vehicle miles traveled (VMT). Therefore, reducing VMT is a major part of achieving sustainability.

The data in Chapter 6 on modes of transportation in commuting to work indicate that 80.8 percent of Acton residents commuted to work in 2000 by driving alone; another 7.4 percent used car pools, and 4.5 percent used public transportation; the remaining 7.7 percent walked, biked, or worked at home. National data indicates that commuting accounts for slightly less than two trips per day per household, despite the fact that households with two wage earners may have four commute trips per day; however, many households have retirees who do not commute at all. On the other hand, the total number of trips per household is typically between eight and nine, including the commuting trips. This means that trips for shopping, entertainment, socializing, medical appointments, and other purposes outweigh commuting trips by more than four to one. This is significant because even those residents who use modes other than driving alone to commute are likely to drive to most other destinations.

Chapter 6 discusses transportation and the potential for energy saving modes such as public transportation and shuttle bus, walking, and bicycling. All of these modes are highly dependent on favorable land use patterns that provide enough density to make public transportation feasible and destinations close enough together to make walking and bicycling reasonable alternatives. For people who live in a village like West Acton, there are more non-automobile dependent options for some of the trips they take each day, and it may be feasible to serve other trips such as to Town hall and Memorial Library or to the large supermarkets by shuttle van. More use of shuttles, walking, and bicycling are ways to reduce household energy use for transportation.

### **Motor Fuel Use**

Transportation energy use depends on both the efficiency of the automobiles used for the trips and the total number of miles driven for all purposes. However, an order-of-magnitude estimate is possible. Metropolitan Area Planning Council (the regional planning agency for 101 cities and towns around Boston), working with MIT Department of Urban Studies and Planning, estimated that the average vehicle miles traveled (VMT) by an Acton household is 76.0 miles per day or approximately 28,000 miles per year. (This data is derived from Registry of Motor Vehicle inspection records and thus includes trips for all purposes, not just commuting.) Acton ranks 212 among the 351 Massachusetts cities and towns in VMT.

Table 9.4 shows the average vehicle miles traveled per day by households in Acton and the adjoining communities.

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<sup>5</sup> This figure is based on all energy use, including in its base the use of energy in the production and transportation of goods and provision of government and private sector services.

Table 9.6 Vehicles Miles Traveled and Vehicles per Household, Acton and Adjoining Towns

	Average Daily Vehicle Miles Traveled (VMT) per Household	VMT per Household Rank in Massachusetts <sup>1</sup>	Passenger Vehicles per Household
Acton	76.0	213	2.1
Boxborough	82.3	262	2.1
Carlisle	86.5	290	2.5
Concord	64.4	123	2.0
Littleton	84.2	276	2.2
Maynard	58.4	174	1.8
Stow	85.7	285	2.4
Sudbury	79.2	242	2.3
Westford	88.1	298	2.4
average	78.3		2.2

Source: MAPC; data collected 2005-2007 from Massachusetts Registry of Motor Vehicles

<sup>1</sup> Higher rank indicates higher vehicle miles traveled.

*Acton households had the third lowest vehicle miles traveled among the nine adjoining towns, averaging 76.0 miles per day for all purposes.* Total vehicle miles traveled is influenced by the availability of an automobile for each driver, by the use of an automobile instead of public transportation, biking, or walking, and by the distances to work, shopping, and other destinations. For comparison, Cambridge and Brookline households averaged 23 and 24 vehicle miles per day and owned an average of 0.9 and 1.0 passenger vehicles; these low numbers are made possible by their urban density and availability of public transportation.

**Carbon Footprint from Passenger Vehicles:** Assuming 20 miles per gallon and 76.0 vehicle miles traveled per day, the average Acton household uses nearly 1,400 gallons of fuel per year, which results in 13.5 tons of CO<sub>2</sub> emissions per year. For Acton's 8,415 households, the total vehicle miles traveled burn approximately 12 million gallons of fuel, resulting in 117 tons of CO<sub>2</sub> entering the atmosphere<sup>6</sup>.

## Overall Summary

Acton has made a serious commitment to sustainability in its membership in ICLEI and its certification under the Massachusetts Green Communities Act. The Town has completed a benchmark survey of its energy use in schools and other public buildings and is working to improve the energy efficiency of these buildings and to encourage behavior that reduces energy use.

<sup>6</sup> The U.S. Environmental Protection Agency uses the conversion factor 19.4 pounds of CO<sub>2</sub> per gallon of gasoline.

Table 9.7 Estimated Acton Carbon Footprint

Greenhouse Gas Emissions Sources	Lbs of CO2 equiv	Tons of CO2 equiv	Percent
Residential / Electric	98,000,000	49,000	15.1%
Residential / Natural Gas	45,484,263	22,742	7.0%
Residential / Oil	41,000,000	20,500	6.4%
Residential / Gasoline for Vehicles	279,445,381	139,723	43.0%
Commercial+Industrial / Electric	120,135,400	60,068	18.5%
Commercial+Industrial / Natural Gas	39,370,331	19,685	6.1%
Town+School / Electric	14,525,000	7,263	2.2%
Town+School / Natural Gas	5,742,000	2,871	0.9%
<b>Total</b>	<b>643,702,375</b>	<b>321,851</b>	<b>100.0%</b>
Residential Only:	463,929,644	231,965	72%
Per capita (population 21, 924 per US 2010 Census)	21,161	10.6	
Per Household (8415 per Acton Town Clerk)	55,131	27.6	

Source: Calculations in Appendix

Note: This table excludes the energy associated with solid waste.

More refinement of the data is needed, particularly with respect to the amount of oil heat used by Acton residents (see discussion above). Additional work is also needed to estimate the energy and resultant carbon emissions associated with Acton's solid waste. This involves both the rate of recycling and the destination of the solid waste: incineration at a waste-to-energy plant whose electrical power is sold to the electrical grid actually reduces regional carbon emissions compared to coal-fired electrical generation.

However, some observations can be made.

Gasoline for personal transportation is the largest single category of energy use and carbon emissions; it amounts to 43 percent of the Town's carbon footprint and 59 percent of the residential total, while electricity and heating fuels each account for approximately 20 percent.

Acton's per capita energy use for home heating, electricity, and personal transportation is in line with the national average primary footprint, about 10.4 tons of CO2 per capita, excluding air travel<sup>7</sup>. The footprint calculation leaves out the carbon associated with personal air travel, which might be estimated through a survey. For many American households, the carbon emissions from air travel may be of the order of magnitude of 10 tons of CO2 equivalent per household.

The tools are in place to advance the other objectives related to sustainability: management of water, wastewater, and stormwater, preservation of agricultural land, and reduction of solid waste and toxic materials that enter the environment. More can be done in all these areas. The following list of opportunities and challenges related to environmental sustainability.

<sup>7</sup> U.S.EPA Household Emissions Calculator

[http://www.epa.gov/climatechange/emissions/ind\\_calculator.html](http://www.epa.gov/climatechange/emissions/ind_calculator.html)

## **Opportunities and Challenges Posed by the Existing Conditions**

- Preserving water quality involves the opportunities and challenges described in Chapter 7, Facilities and Services, including measures to implement the Comprehensive Water Resources management Plan.
- Acton's public open space including conservation land and Morrison Farm provide opportunities to preserve biodiversity and to promote local agriculture.
- There may be opportunities to provide pick-up points for Community Supported Agriculture in locations like the farmer's market in West Acton village.
- Water supply for irrigation may be a challenge in expanding community gardening.
- Since farmland is generally well-drained and easily developable, development pressure on private agricultural land is a challenge to sustaining its use. Community Supported Agriculture is a potential opportunity for promoting local agriculture.
- The fact that Acton does not have public curbside trash pickup is a challenge to increasing the rate of recycling of solid waste; however, there is an opportunity to facilitate recycling at the TCRP by exploring single stream recycling, and some aspects of keeping material goods out of the waste stream can be served at the TSRC, for example setting up swaps of usable goods from one household to another.
- Providing financial incentives such as free disposal of recyclables while charging on a per-bag basis for non-recyclables would be an opportunity to improve the recycling rate.
- Acton's baseline/benchmark data can be the basis of ongoing efforts to encourage progress in saving energy, both in public buildings and in Acton's households and businesses.
- Acton households' use of substantially more electricity than average NStar customers will be a challenge to reducing energy use.
- Energy prices worldwide are expected to trend upward over the next decade. This is an opportunity to encourage energy conservation by households and businesses. Currently low interest rates increase this opportunity by shortening the payback period on investments such as household energy improvements. This is therefore an opportune time for Town programs to encourage home and business energy improvements.
- Acton's low density land use pattern makes encouraging less driving a challenge; however, there are opportunities to strengthen (and emulate) existing villages which are more amenable to reducing vehicle miles traveled.

In conclusion, Acton is on the path to environmental sustainability, but continued effort is needed to reach the goal. In the area of reducing energy use (and therefore carbon emissions) there is much more to do, but the Town has made a strong start with its Green Community Status and commitment to the ICLEI milestones.